

# Gamma Ray Observatory to April 5, 1991



# Early Capabilities Limited

Limited or no telemetry

Tape recorders (no solid state memory)

Discrete electronics

Limited processing power

- In space
- on ground

Limited position and timing capability needed for pulsar studies

Limited payload capacity for space launches

# Motivation for Gamma-Ray Astronomy

Are cosmic rays galactic or extra-galactic?

If cosmic rays are galactic how can you probe the galactic distribution?

If galactic what is the distribution of protons versus electrons?

Are the newly discovered gamma-ray bursts galactic or extragalactic in origin?

Detectors not traditional telescopes as in other portions of the electromagnetic spectrum by detectors borrowed from the physics community.

# Theoretical Motivation

Feenberg and Primakoff, 1946, “Interaction of Cosmic-Ray Primaries with Sunlight and Starlight” Phys. Rev. Letters.

Fermi, 1955, “Nuclear Physics”, Notes Compiled by J. Orear.

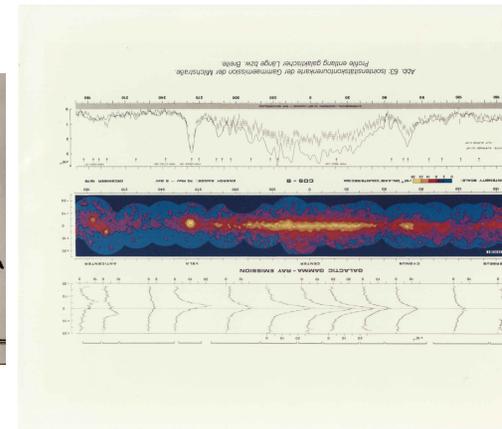
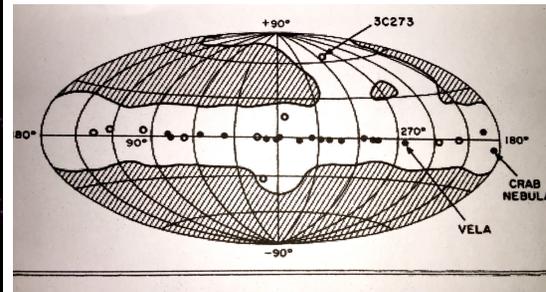
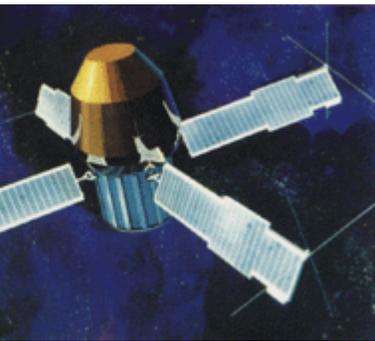
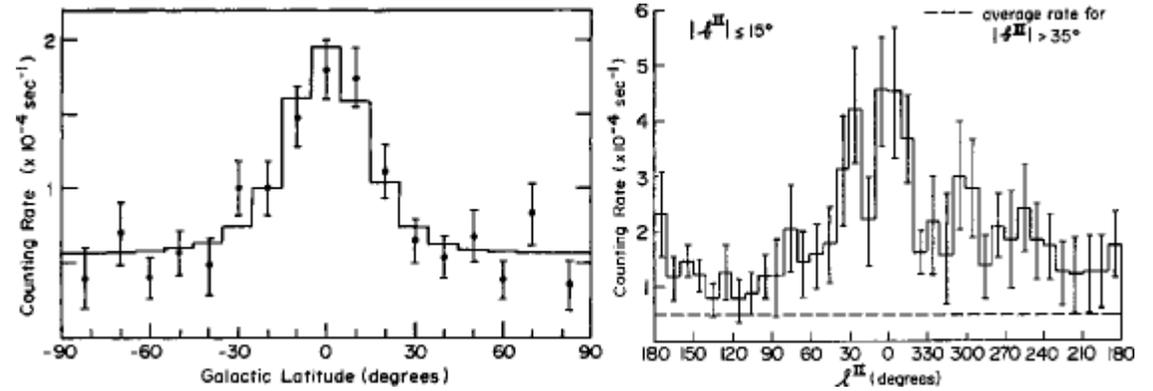
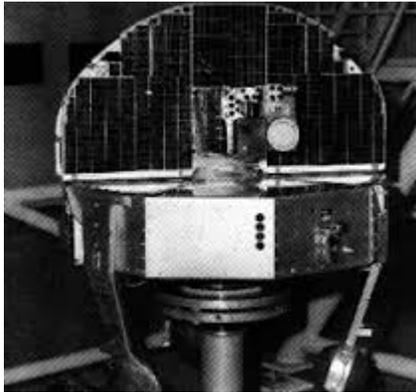
Morrison, 1958, “On Gamma-Ray Astronomy”, Il Nuovo Cimento.

Ginzberg and Syrovatskii, 1965, “Some Problems of Gamma- and X-Ray Astronomy, Soviet Phys.-Uspekhi

Fazio, 1967, Gamma Radiation from Celestial Objects, Annual Rev. of Astronomy and Astrophysics.

Discoveries not based on theory: Gamma-ray Bursts (Vela), Gamma-rays from AGN (EGRET), Gamma-Ray Pulsars

# Before GRO

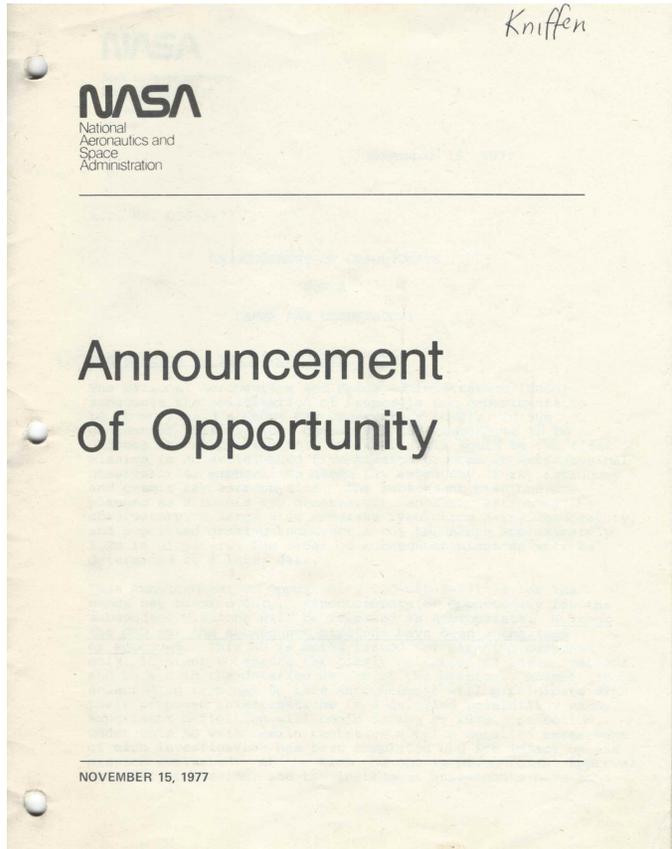


# Pre-GRO Launch Operations

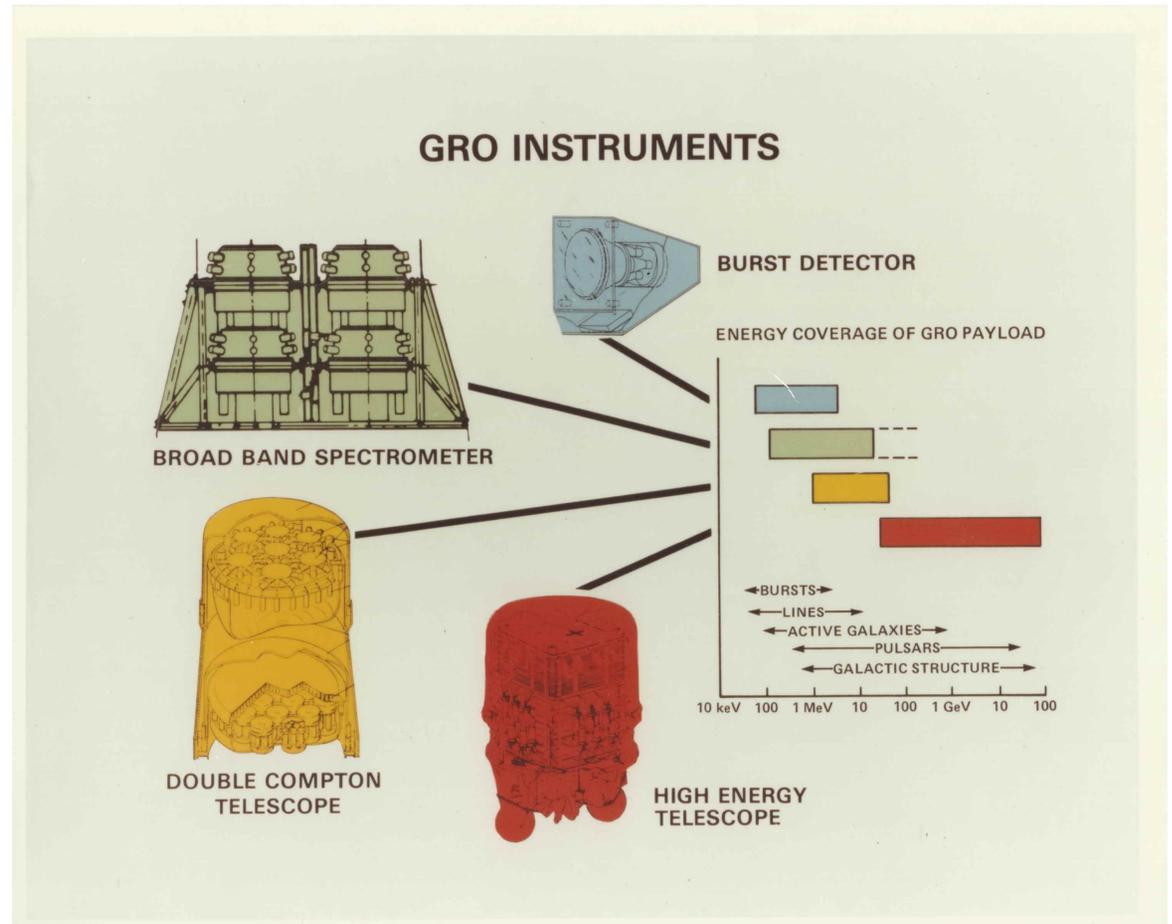


Launch Operations of NASA's second Small Astronomy Satellite from the Italian San Marco launch platform in the Indian Ocean off the coast of Kenya in 1971.

# Gamma Ray Observatory



November 15, 1977



Following the premature ending to SAS-2, Fichtel and Macdonald worked tirelessly to convince NASA to include a Gamma Ray Observatory to explore the full gamma-ray portion of the electromagnetic spectrum. Originally announced as a one-year mission when launched it had become a three-year mission that was deorbited after nine years on orbit.

# WHO IS INVOLVED IN THE GAMMA RAY OBSERVATORY?

GODDARD SPACE FLIGHT CENTER  
GRUMMAN AEROSPACE CORPORATION  
MARSHALL SPACE FLIGHT CENTER  
NAVAL RESEARCH LABORATORY  
UNIVERSITY OF NEW HAMPSHIRE  
NORTHWESTERN UNIVERSITY  
RICE UNIVERSITY  
STANFORD UNIVERSITY  
ESTEC DEPARTMENT OF SPACE SCIENCE, NETHERLANDS  
UNIVERSITY OF LEIDEN, NETHERLANDS  
MAX-PLANCK INSTITUT, GARCHING, WEST GERMANY  
ROYAL AIRCRAFT ESTABLISHMENT

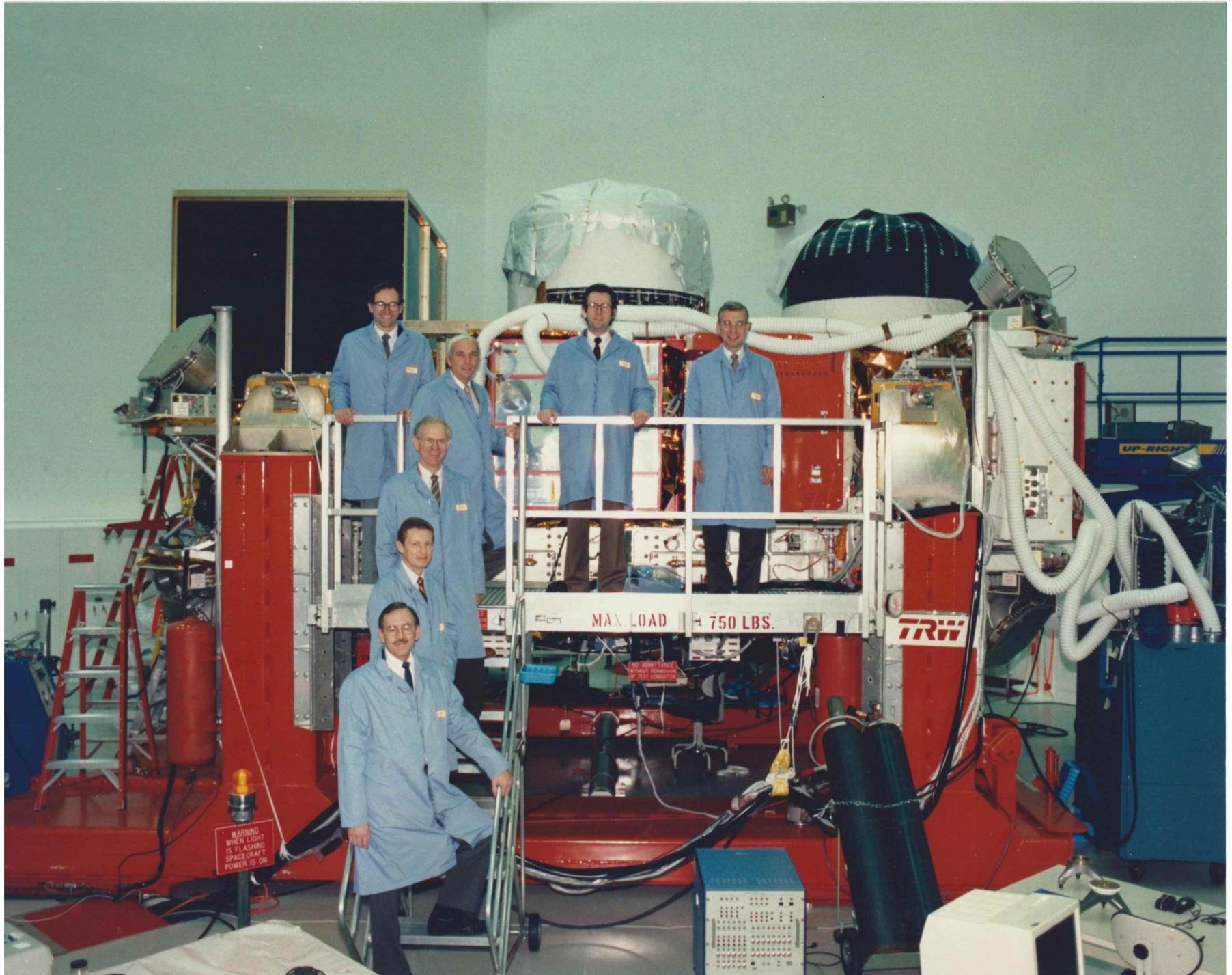


# WHY THE GAMMA RAY OBSERVATORY?

- **FIRST MISSION TO STUDY THE FULL RANGE (OVER FIVE DECADES) OF GAMMA RAY PHENOMENA**
- **WILL SEE SOURCES 10 TIMES FAINTER THAN PREVIOUS INSTRUMENTS**
- **WILL IMPROVE KNOWLEDGE OF SOURCE POSITIONS BY FACTOR OF 50-100**
- **WILL EXPLORE PREVIOUSLY UNOBSERVED PORTIONS OF GAMMA RAY SPECTRUM**







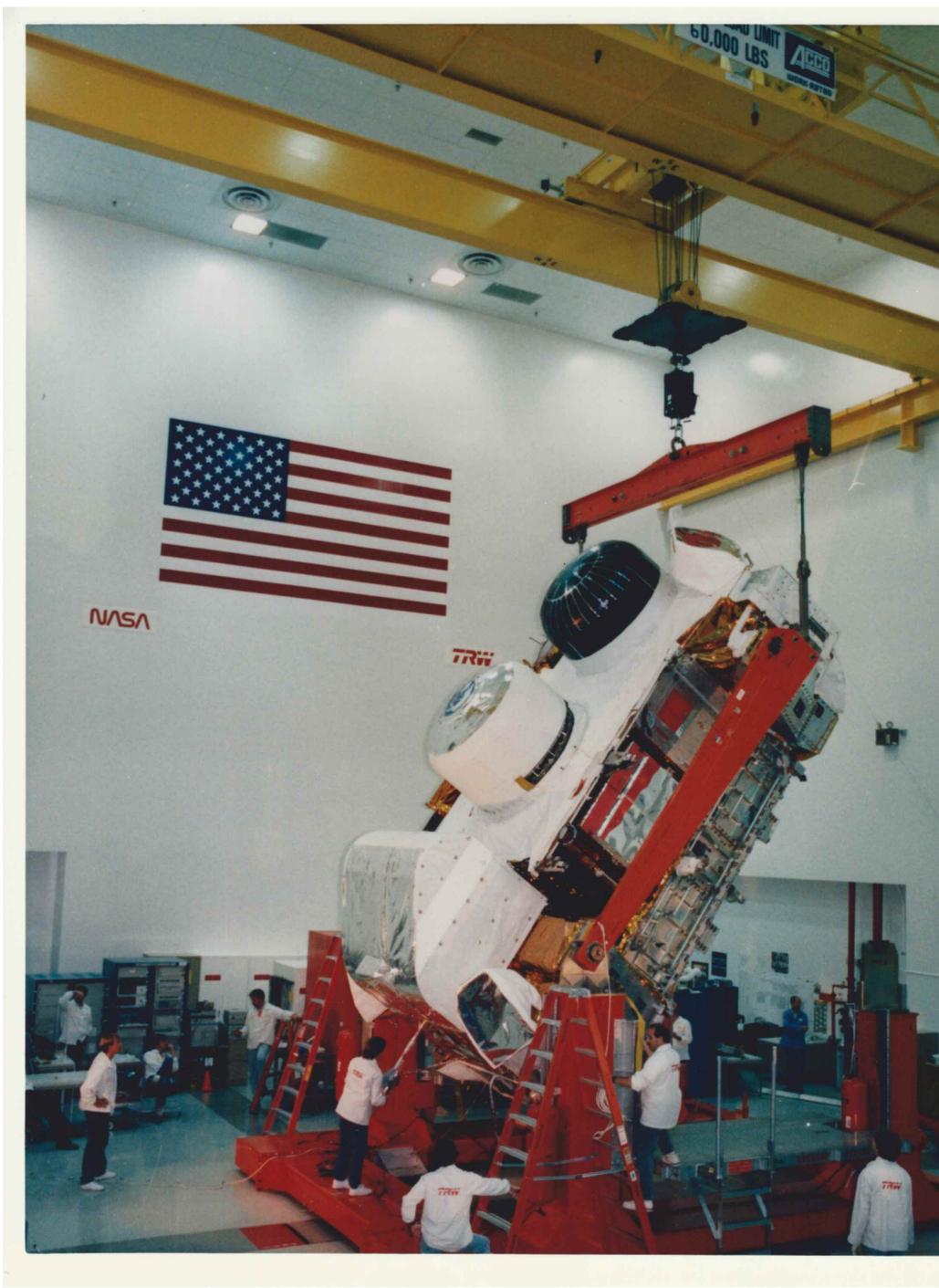
WARNING  
WHEN LIGHT  
IS FLASHING  
SPACECRAFT  
POWER IS ON

MAX LOAD 750 LBS.

TRW

UP-RIGHT

NO ADMITTANCE  
WITHOUT PERMISSION  
OF TEST CONDUCTOR





PRIOR TO WORKING  
ABOVE SPACECRAFT  
- EMPTY SHIRT POCKETS  
- REMOVE JEWELRY  
- TETHER EYEGLASSES  
AND TOOLS  
- SHOE COVERS MUST  
BE WORN

MAX. LOAD 750 LBS.



April 5, 1991  
09:22:44 EST  
after 4:45 minute  
weather hold

Heaviest scientific payload  
(35,000 pounds), even  
at the time.



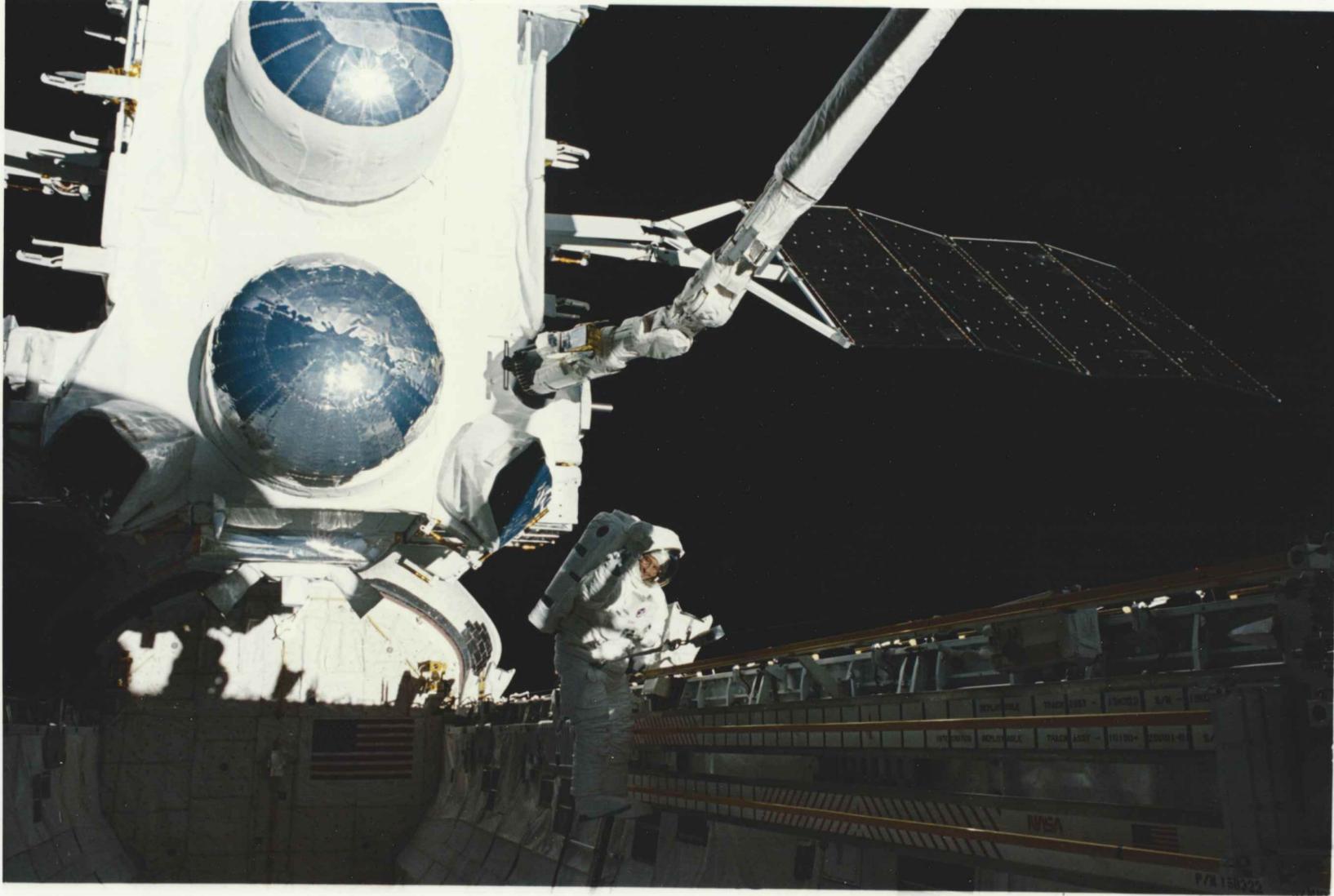
Launched on a rainy  
morning on April 5, 1981  
Caught the User's Conference  
by surprise while they  
looking the other way



National Aeronautics and  
Space Administration

S 37 - 51 - 021

Lyndon B. Johnson Space Center  
Houston, Texas 77058



Near calamity  
high gain antenna  
Is stuck during  
deployment  
Ross and J  
to the rescue



# What did we learn?

- Extended mission duration led to a robust Guest Observer program
  - Run by the CGRO Science Support Center the CGRO GO was well managed and was successful in generating many important user investigations.
  - GO Participation was difficult to support because the GO program was an after thought when the program was extended to 3 years and beyond. Each instrument had its own data processing and archiving system.
  - With a small gamma-ray astronomy community, the CGRO GOs became a large and vocal support group not just for CGRO, but built community support for a follow-on mission (Fermi Gamma-Ray Observatory).
- The Compton Fellowship Program was very successful in attracting bright productive young scientists into the field.
- The close working relationship between the GRO Project Staff and the PI Teams led to many enhancements in the scientific return. The mission might have failed at the start had not the GRO Project Staff planned for the possibility of problems in the deployment of the appendages (solar panels and high-gain antenna). The CGRO scientific community will forever be indebted to the heroic efforts of Jerry Ross and Jay Apt in rescuing what could have been a very crippled Observatory. This was the first extravehicular activity in 6 years.
- The most significant early failure of both tape recorders actually was a fortuitous benefit to the study of gamma-ray bursts allowing immediate notification of bursts to other observers for followup observations.